REMARKS

(A) Status of the Application

(I) Disposition of Claims

(i) Claims 1-10 are pending in the application.
(ii) Claims 10-22 were previously canceled.
(iii) Claims 1-10 are rejected.

(II) Applicants' Action

(i) We have amended Claims 1-10.
(ii) We respond to the 35 U.S.C. §§ 102(b) rejection.

(B) Anticipation and/or Obviousness Rejection under Nakamichi Reference—Claims 1-10

In the September 22, 2008, Office Action (the "Office Action"), Claims 1-10 of the present patent application ("AD6883") are rejected under 35 U.S.C. § 102(b) as anticipated by, or in the alternative, under 35 U.S.C. § 103(a) as obvious over U.S. Patent No. 5,028,461 to Nakamichi, ("Nakamichi").

We respectfully disagree with the Examiner that Nakamichi anticipates or obviates Claims 1-10 (under 35 U.S.C. §§ 102(b) & 103(a), respectively) and traverse for the following reasons.

According to the Examiner, "Nakamichi teaches an ovenware item comprising a thermoplastic polymer with a filler (abstract), the filler being carbon black containing graphite (column 3, line 53), up to 70% carbon black (abstract),. . ." Respectfully, this is the Examiner's interpretation of what Nakamichi states, and not what Nakamichi actually states. In actuality Nakamichi states that he uses "polyarylene sulfide resin" (abstract and throughout the reference). For example, the current Claims 4, 6, and 8 relate to "liquid crystalline polymer" and polyarylene sulfides are not liquid crystalline polymers.

Insofar as what fillers the resin may contain, while the Abstract states "containing 20-70% by weight glass fiber or glass fiber **and** other inorganic filler" (emphasis added), it fails to mention the inorganic filler. The paragraph at Col. 3, Lines 57-64 states in essence that minimum amount of glass fiber should be at least 20%, so at the most the inorganic filler is 50 wt.%.

What the inorganic filler may be, is given at Col. 3, Lines 51-56. Of the fourteen specific fillers listed, one is "carbon black." However, one of average skill in the art of filled polymers would take this list to just be exemplary of inorganic fillers in general, especially since the first words in the paragraph are "Example[s] of the inorganic filler are. . ." In other words, one is not led to the idea that a highly thermally-conductive filler should be used. Carbon black and carbon fiber have high thermal conductivities, but it is believed the other fillers listed do not.

Thus, Nakamichi discloses a polyarylene sulfide resin filled with glass fiber, and optionally with one or more other inorganic fillers, with these other fillers present in an amount of 0% to 50 wt.%, depending in part on the amount of glass fiber present (the maximum amount of inorganic filler present is presumably 70 wt.% minus [amount of glass fiber] percent by weight). Nothing at all is stated that carbon black or any other highly thermally-conductive filler is preferred or that thermal conductivity of the filler is an important property of the filler.

It is well established that "[r]ejection for anticipation requires, as first step, that all elements of claimed invention be described in single reference, and such reference must describe Applicants' claimed invention sufficiently to have placed person of ordinary skill in possession of it."[1] "An anticipating reference must describe the patented subject matter with sufficient clarity and detail to establish that the subject matter existed in the prior art and that such existence would be recognized by persons of ordinary skill in the field of the invention."[2] Furthermore, "[a] single reference must describe the claimed invention with sufficient precision and detail to establish that the subject matter existed in the prior art."[3] One supposes this may all be summarized as the reference must disclose the invention sufficiently that one or average skill in the art would recognize the presently claimed invention and be able to implement it from the reference.

This is simply not the case here. The Examiner describes Nakamichi in hindsight of the Applicants' invention, which as the examiner is undoubtedly aware is not allowed. The reference does not recognize that high thermal conductivity of the polymer composition is important, that it can be achieved using a thermally conductive filler, and that the thermally conductive filler must be present in a sufficient amount to adequately raise the thermal conductivity of the polymer composition. Therefore these claims are not anticipated by Nakamichi.

Furthermore, for essentially the same reasons, the claims are not rendered obvious by Nakamichi. Again the person of average skill in the art is not "led" to the present invention by Nakamichi for the reasons discussed above for the anticipation rejection, and therefore these claims are not obvious over Nakamichi.

In light of the above differences, Nakamichi is a non-anticipatory and a non-obviating reference to AD6883. Applicants respectfully submit that each of Claims 1-10 are novel over Nakamichi and that the Examiner withdraw the 35 U.S.C. §§ 102(b) and/or 103(a) rejections.

(C) Anticipation Rejection under Suzuki Reference—Claims 1-10

Claims 1-10 have been rejected under 35 U.S.C. 102(b) as being anticipated by WO98/48414 to Suzuki, *et al.* (represented by U.S. Patent No. 6,641,878 to Suzuki, et al., hereinafter "Suzuki"). Applicants traverse for the following reasons.

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1 *In re Spada*, 15 USPQ2d 1655 (Fed. Cir. 1990).

2 *Crown Operations International Ltd. v. Solutia Inc.* 62 USPQ2d 1917 (Fed. Cir. 2002).

3 *Verve LLC v. Crane Cams Inc.* 65 USPQ2d 1051 (Fed. Cir. 2002).

Applicants agree with the Examiner's interpretation of Suzuki in the Office Action except for two points. The test at Col. 8, Line 15 does not state what the melting point of the poly(arylene sulfide) is, but merely that the viscosity is when measured at 310°C. This paragraph merely means that the polymer is usable in the liquid state at 310°C and melts at **or below** that temperature. One skilled in the art knows that generally the melt-viscosity is measured at temperatures significantly higher than the melting point of the polymer. However, Applicants will not argue that certain poly(arylene sulfides) have melting points of 250°C or more. More importantly poly(arylene sulfides) are not, as stated in the Office Action, liquid crystalline polymers (LCPs). The paragraph at Col. 3, Line 19, merely states that polyarylene sulfides may be used, not that they are LCPs. If the Examiner still believes poly(arylene sulfides) are LCPs, he is requested to provide proof of that statement.

The office action goes on to state that the preamble is not considered a limitation of the claims, and therefore the "ovenware item" limitation is not considered as differentiating Suzuki. We have amended the claims so that the ovenware item is now a limitation, and are differentiated from Suzuki. It is noted that Suzuki does not mention items for ovenware.

Suzuki is not directed toward ovenware suitable for heating and/or cooking food or drink, but shows a tiny housing (drawing in patents are not considered to scale unless so stated), and this housing is used for optical components. Hereinafter, reference will be made to the "housing" of Suzuki to clearly distinguish it from Applicants' claimed ovenware. The opening to the Suzuki sealed housing is very small and is present to allow a laser beam to leave and a reflection to enter the housing. It would be impossible for a practical application to add or remove food or drink from the housing. One skilled in the art would not look to an optical pickup device housing for ovenware for cooking or heating food or drink.

In addition, there are significant differences between the "housing" of Suzuki and the presently claimed ovenware. In Suzuki, the reason for forming a housing having high thermal conductivity is not to heat something but to cool the contents of the housing and the housing itself (see Col. 1, Lines 58-65 of Suzuki's U.S. equivalent for a more extensive discussion of optical pick-ups to which Suzuki is directed). The housing that Suzuki discloses is for holding certain types of electronic devices, especially radiation sources. The devices generate heat internally in the housing (see Suzuki, col. 1, lines 55-65). In order to prevent overheating of these devices and the housing itself, it is preferable that the housing have a high thermal conductivity so that heat is dissipated. In contrast, the present ovenware is designed to heat the contents placed in the ovenware by absorbing microwave radiation. More importantly, the housings of Suzuki are not suitable for heating or cooking food because, for one reason, as mentioned above, they are too small. These optical housings of Suzuki are very tiny and not at all suitable for food use. In support of this, see the following enclosed documents, which were downloaded from the internet:

(a) Japan's Near Term Optical Storage Roadmap;

(b) Recordable Optical Pickup Head for Blu-ray Disc;

(c) "New Products" about PXR-724U;

(d) Victor JVC Optima 73;

(e) Victor JVC Optima 71-5; and

(f) Victor JVC Optima 725.

These documents will be referred by the letter designation, and are submitted herewith. Optical pickups in general are described on Page 5-6 of document (a), and this discussion emphasizes the trend towards smaller and smaller assemblies. The remainder of the documents, (b)-(f) describe various actual optical pickups, and in particular give dimensions of those pickups. The pickups include not only the housing of Suzuki, but also associated wiring, mounting, electrical connectors, etc. This is clearly seen in document (b), wherein the black "box" in the lower left hand corner is the housing that concerns Suzuki. From the ruler in the picture, and the overall dimensions, we can roughly estimate that this box has dimensions of 30 x 43 x 18 mm (exterior dimensions). This means the housing encompasses a volume of less than about 0.023 Liter (0.8 fl. oz). We can estimate the volume of the JVC housings even more accurately since it gives dimensional drawings. For example, from the drawing of the Optima 71-5 it appears that the housing outer dimensions are 15 x 14 x 8.7 mm. This is a volume of less than about 0.018 Liters (0.6 fl oz.). The aperture (hole) in this housing for the laser(s) to shine through is 4 mm in diameter. Similar estimates may be made for the other pickups illustrated in these documents.

Ovenware, or any item used for heating or cooking foods, must have several shape and "dimensional" attributes to be useful. The shape must be one that can reasonably hold the food, and the food must be easily added to and removed from the ovenware. In addition the shape must be such that it can be rested in a stable position in which the food does not spill during heating. Finally the ovenware must be of a suitable volume. It must have a reasonable minimum working volume so that a "normal" amount of food may be heated.

The housings of Suzuki, as illustrated in the above mentioned documents, are so small that no reasonable person would use them, or even think of using them, for heating or cooking food. They simply would not hold enough to be useful, and food would be difficult or impossible to add or remove from them through the small apertures.

In addition, Suzuki does not describe the sizes of its housings, so it is reasonable that one skilled in the field of optical pickups would assume that the dimensions of the housings that Suzuki describes would be of the size shown in the documents. Furthermore, the housings of Suzuki have some additional attributes that render them not useful as ovenware. For example, these housings normally have electrical leads through their walls to connect the electronic devices inside the housings to the rest of the optical pickup and the apparatus as a whole. Some of these connections are clearly visible in the drawings/pictures of documents (b)-(f). In addition as noted above the only aperture in these sealed housings is usually the hole through which a laser or similar device shines and whose reflection is recorded. As noted above, this hole is normally very small, in the case of the Optima 71-5, it is 4 mm in diameter, far too small to be useful in filling or emptying the housing of food.

The use of the term "ovenware" specifically limits these claims to containers useful for heating and/or cooking food, and is not a container useful for heating (or cooling) an "industrial device" as set forth in Suzuki unless such a device can be reasonably used for heating or cooking food which, as pointed out above, the housing disclosed by Suzuki certainly can not be used for such purposes. Thus Suzuki does not anticipate these claims.

In light of the above differences, Suzuki is a non-anticipatory reference to AD6883. Applicants respectfully submit that each of Claims 1-10 are novel over Suzuki and that the Examiner withdraw the 35 U.S.C. § 102(b) rejection.

(D) Anticipation Rejection under Nagano Reference—Claims 1-10

Claims 1-10 have been rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 5,976,406 to Nagano, *et al.* ("Nagano"). Applicants traverse for the following reasons.

Again, while the Examiner correctly describes the reference, it reflects hindsight knowledge of the present invention. For instance Col. 4, Line 32-50 make clear that any plate inorganic filler may be used, and graphite is just one of these. Also the amount of graphite is such that amounts giving a thermal conductivity of less than 1.0 W/m°K can be chosen. Thus as described above, the person of average skill in the art is not put in possession of the composition necessary for the present invention.

Just as importantly, Nagano does not mention ovenware or anything even close to ovenware. It mentions as uses mostly electrical or electronic parts, including parts for microwave ovens (Col. 5, Lines 33-43), but not ovenware in which food is cooked. Nagano does not specifically describe any article which would be suitable for ovenware. Particularly with the amendments of the claim, this limitation is not met by Nagano. Therefore these claims are not anticipated by Nagano.

In light of the above differences, Nagano is a non-anticipatory reference to AD6883. Applicants respectfully submit that each of Claims 1-10 are novel over Nagano and that the Examiner withdraw the 35 U.S.C. § 102(b) rejection.

(E) Anticipation Rejection under Nomura Reference—Claims 1-10

Claims 1-10 have also been rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 5,529,716 to Nomura *et al.* ("Nomura). Applicants traverse for the following reasons.

Applicants agree with Examiner's description of Nomura and also agree that probably the higher aluminum amounts will lead to relatively high thermal conductivity of the LCP compositions. However, the only use cited for Nomura's composition (Claim 1 for instance) is as a lamp reflector. Nomura does not give any description of his lamp reflector, and therefore does not describe any equivalent of an ovenware item. Since Nagano does not recite ovenware or an equivalent structure, it does not anticipate these claims.

In light of the above differences, Nomura is a non-anticipatory reference to AD6883. Applicants respectfully submit that each of Claims 1-10 are novel over Nomura and that the Examiner withdraw the 35 U.S.C. § 102(b) rejection.

(F) Claim Amendments

Claim 1 has been amended to recite that what is being claimed is an article, which is an ovenware item which comprises the defined composition. Claims 2-10 have been amended—since they ultimately depend from claim 1—to recite the article of claim 1. Basis of these amendments are the original claims, which have not changed in meaning.

Applicants amended these claims in response to the Examiner's comments in the various rejections under 35 U.S.C. §§ 102 and/or 103 that the preamble has been given no patentable weight. The Examiner also comments that the preamble should be given no weight "where the body of the claim does not depend on the preamble for completeness." Applicants believe that if original Claim 1 was read without the preamble, that is, starting with the word "comprising", it would be meaningless since one would not know what comprised the stated composition. However to expedite prosecution Applicants have amended the claims as described above.

CONCLUSION

In view of the above remarks, we have properly traversed the 35 U.S.C. §§ 102(b) & 103(a) rejections in the Office Action and have completely responded to the September 22, 2008, Non-Final Office Action.

The application is therefore allowable. We respectfully solicit that the PTO withdraw the rejections and allow the claims.

Please contact the undersigned (Applicants' attorney) for questions and charge any unaccounted for fees to Deposit Account No. 501447 (Potter Anderson & Corroon, LLP).

RESPECTFULLY SUBMITTED,

DATE: JANUARY 21, 2009

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JAPAN'S NEAR-TERM OPTICAL STORAGE ROADMAP

Beyond the present multimedia application with limited moving images, new optical storage applications are appearing on the horizon, such as full-frame video storage with capabilities for interactive control, image database storage, floppy replacement, and multiplatform computing. In order to address these new applications, the capacity of optical disks must continue to increase over the next five years while the price of the media must continue to drop. Using various new techniques, the Japanese optical storage industry is following a well-planned roadmap to reach these goals.

Japanese industry officials foresee 4 GB capacity per disk as an important threshold that needs to be reached to enable digital video storage: a one-minute video clip using 24-bit color and 640 x 480 pixel frames requires 33 MB of storage capacity using MPEG-2 (the industry standard for video compression) and assuming a compression rate of 30 -- for a two-hour video, this translates to about 4 GB. (Depending on the fidelity of the compression technique used, this number may vary widely.) Japanese projections indicate that the 5.25 in. standard-format read-write-erase disks will reach this critical 4 GB capacity by mid-1997, as Figure 3.8 shows. Toshiba, Matsushita, and Sony are aggressively pursuing CD formats that offer lower-cost solutions at the expense of longer access times.

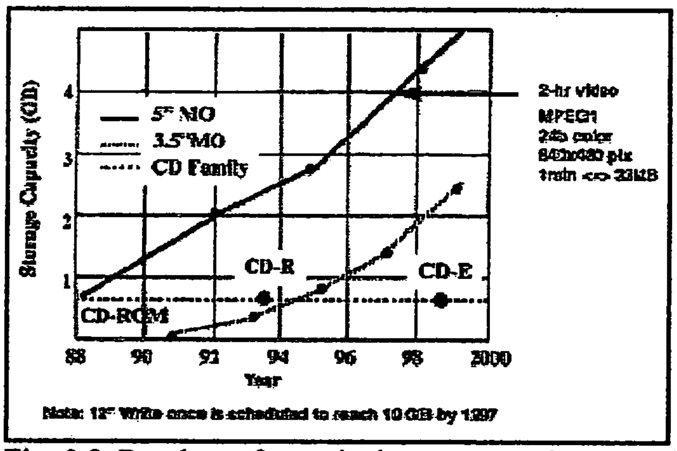


Fig. 3.8. Roadmap for optical storage products at Hitachi-Maxell.

In addition, in order to better address video-on-demand applications, 12 in. WORM products are scheduled to reach 10 GB, and 3.5 in. products are scheduled to reach more than 1 GB capacities by mid-1997. Japanese companies are actively pursuing various techniques to radically enhance the performance of optical disk systems to these levels.

Advances in Optical Storage Media in Japan

Most of the companies the JTEC panel visited in Japan were involved with magneto-optical (MO) media, which is presently the workhorse of the data storage industry. However, they are also actively investigating, at development and production levels, the phase-change media championed by Matsushita. Matsushita offers several product lines that use this technology, and it plans to announce several more. A diversity of opinion exists between companies as to if and when phase-change media will replace magneto-optical media.

Magneto-optical media

Each technology has its strengths and weaknesses. The magneto-optical (MO) approach is based on thermomagnetic domain switching of magneto-optical materials. When in the presence of a magnetic field, a focused laser beam heats a small region in a magneto-optic thin-film material (e.g., TbFeCo), the magnetic domains in the heated area orient themselves with respect to the magnetic field direction and polarity. By keeping the direction of the magnetic field the same but reversing its polarity, the magnetic domains are restricted to remaining in two distinct states (up or down), as described by the arrows in Figure 3.9. Domains in different states exhibit different optical properties, imposing different polarization retardation onto the readout laser beam as a result of the Kerr effect. The resulting optical polarization modulation is, however, very small (less than 1 degree rotation), requiring relatively complex optical head designs and receiver circuits. In addition, a magnet is required during recording, making the setup bulkier and increasing the power requirements.

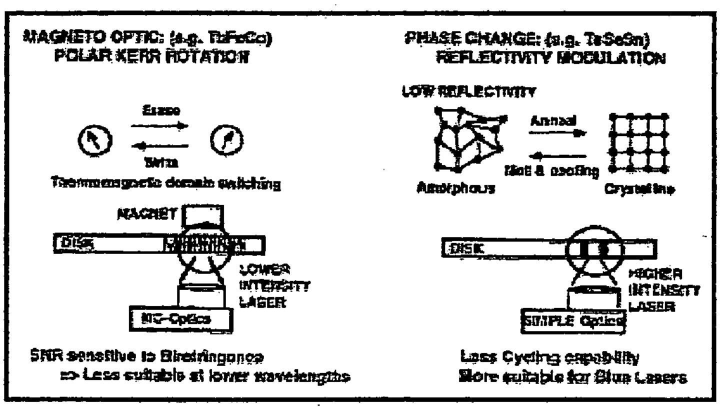


Fig. 3.9. Reversible optical storage media in production.

Other major shortcomings of the MO approach are becoming apparent. As the wavelength of the recording and readout laser is shifted towards the blue for increased storage density, the birefringence exhibited by the plastic materials that protect and support the magneto-optic thin film increases. This parasitic birefringence exhibits itself directly as an increase in background noise, significantly reducing the available signal-to-noise ratio during readout. Thus, an important area of active research on MO media is the search for less birefringent plastic materials that can be used for MO disks with blue lasers.

Researchers at Sony and Hitachi-Maxell are pursuing higher storage densities by investigating the effects of introducing a second active MO material layer into the media system. Each company has discovered a method for increasing capacity using this approach: Sony's magneto-optic superresolution approach and Hitachi-Maxell's multivalued recording approach. The two companies will shortly cross-license their approaches.

Magneto-optic superresolution

Sony's magneto-optic superresolution is achieved by bringing two layers of two different MO materials in close contact with each other. One of the layers behaves as a readout layer and the other as a memory layer. When the readout layer is heated past a certain threshold,

information is copied into it from the memory layer by magnetic exchange coupling. Since the cooler regions of the mark recorded in the memory layer are not allowed to copy into the readout layer, only the peak portion of the laser beam intensity profile affects the readout layer; thus the spot size is effectively reduced.

Multivalued recording

In a similar fashion, Hitachi-Maxell's multivalued recording approach also relies on two layers of magneto-optic films, each having different magnetic properties. However, in this case the two active layers need not to be in close contact. Each active layer has a different recording sensitivity to the recording laser beam intensity, as well as to the strength of the applied magnetic field. By using these properties and modulating the laser beam intensity during recording, researchers at Hitachi-Maxell have demonstrated the feasibility of recording and retrieving four bits of information from the same physical location. This concept has already entered the development and pilot production line phase. (This phase will be lead by the researcher who discovered the original concept.)

Phase-change media

The phase-change approach (Fig 3.9, right column) is inherently simpler than the MO approach (Fig. 3.9, left column). It is based on the cycling of a thin-film material (e.g., TeSeSn) between its amorphous and crystalline states under the influence of a heating laser beam. The material's amorphous state exhibits low reflectivity, while the crystalline state is highly reflective. The optical head design is much simpler than that of the MO approach. Since phase-change media relies not on polarization rotation but on reflection modulation of the readout laser beam, it is not affected by the parasitic birefringence effects; thus, it appears to be better suited for shorter-wavelength recording. The major shortcomings of this technology are its lower cycling capability due to material fatigue (a few hundred thousand write-erase cycles versus more than a million cycles in MO materials) and a possible requirement of higher laser intensity for recording.

It is the panel's belief that the relative success of the magneto-optic and phase-change approaches will be critically dependent on economic rather than performance factors, and the lowest-cost approach will in the end capture the market.

Optical Media Manufacturing and Recording Geometry

An important area of intense study is that of media manufacturing. As described earlier, optical disk surfaces are preformatted in grooves and lands in order to feed back to the servo system the position of the tracks with respect to the optical head. Thus, during the fabrication process these grooves and lands must be transferred to the surface of each disk produced. This is accomplished by generating a master disk on a glass substrate, which is a costly process. The patterns on the master disk are transferred to the surface of each plastic disk produced during an injection molding process. In terms of containing overall costs, it is critical to extend the lifetime of the master disk or to reduce its fabrication cost. In some cases where higher storage density is desired, the substrate of the produced disks can be made out of glass. Japanese glass companies such as NSG are developing various glass substrates and grooving

techniques (e.g., using sol-gel techniques) to lower the cost of glass substrates. Once the disk substrates are preformatted, a series of layers is deposited onto the substrates using thin-film deposition processes in vacuum. Typically, a layer of active magneto-optic thin film is sandwiched between two protective layers, typically AlN, required because of the high chemical reactivity of the active layer materials. A reflective layer is deposited next, and fabrication is finalized by coating the structure with a protective layer. Figure 3.10 shows the final structure.

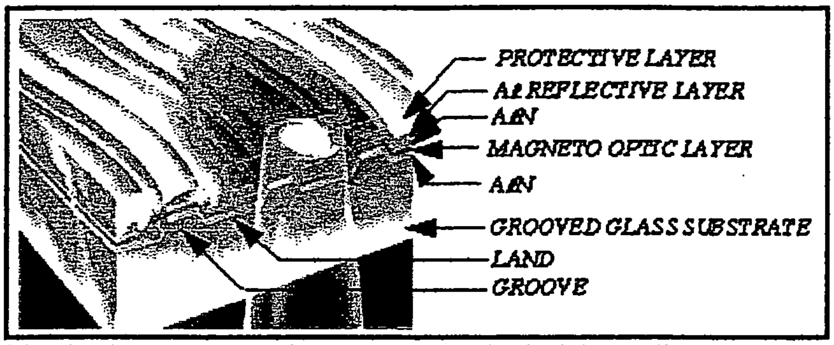


Fig. 3.10. Structure of a magneto-optical disk media (Hitachi-Maxell).

This sequence of processes is critical for achieving defect-free media. Each step is carefully designed, minimizing human involvement, to ensure low-cost, high-quality products. The Japanese have created various media characterization tools and methods to further enhance the reliability of the processes. It was clear in panel discussions with Japanese hosts that they are putting major efforts into media manufacturing; however, the proprietary details of the processes were not discussed.

Another area of progress has been the recording geometry. Traditionally, information has been recorded in the grooves or lands alone. Recently, by using certain noise-cancellation algorithms, Japanese manufacturers have adopted the land and groove recording technique by positioning bits both on lands and in grooves, effectively doubling the track density, as shown in Figure 3.11. For the success of this technique, extensive models have been developed to optimize the depth of the grooves for minimizing crosstalk between data on adjacent lands and grooves and to maximize track pitch for a given wavelength and numerical aperture. Also, some Japanese manufacturers, led by Matsushita, are planning to use *pulse-width modulation* rather than *pulse-position modulation* for their 4X products, to further increase the linear density. In the case of pulse-width modulation, for example, the edges of the mark represent "1," enabling the recording of the sequence "1001" with a single mark. With the present (pulse-position) modulation technique, the same sequence requires four mark spaces. As higher linear bit densities are reached, the inter-symbol interference resulting from the analog nature of the detection channel becomes a limiting factor, effectively smearing the marks. Different digital channels are being investigated, using algorithms to extract the digital information.

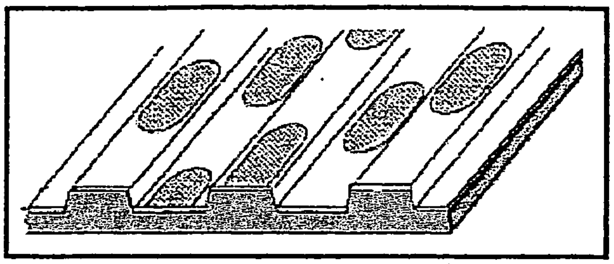


Fig. 3.11. Land and groove recording (Matsushita).

Optical Pickup Heads and Drives

The design and manufacture of the optical pickup head has been a major area of research in Japan, especially in terms of reducing data access time. Designers strive to minimize head mass; manufacturers strive to further reduce manufacturing costs. As described earlier, the main components of the pickup head are the laser, the silicon detectors, the beam-splitters, and the focusing lens. For a competitive head design, the component costs should be minimized while the packaging design should maximize efficient assembly of parts. Japanese manufacturers have so far made significant progress in manufacturing components at very low costs. For example, laser costs have been reduced to $2 per laser, a level that would have been hardly imaginable a decade ago.

Most pickup head R&D efforts are now focused on devising increasingly efficient packaging schemes that employ nontraditional optical components such as holographic beam-splitters in order to reduce the weight of the optical head. The hybrid integration techniques that were developed for combining group III-V compound devices and silicon devices are now being adapted to this end. Figure 3.12 describes an optical head package approach under investigation at Matsushita. First, silicon detectors and possibly their receiver circuits are integrated on a silicon IC using conventional VLSI techniques. An edge-emitting laser is then mounted in a groove etched on the silicon chip, and the laser beam is redirected normally to the surface, using a mirror facet fabricated by anisotropic etching of silicon. A low-mass holographic beam-splitter is used to split the reflected readout beam from the disk surface onto the detectors. It is expected that the package can be produced at lower cost with faster access times.

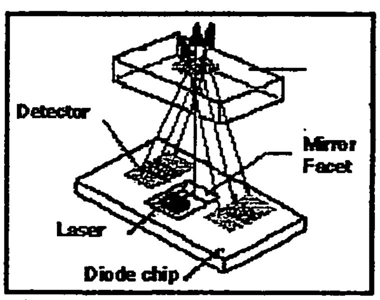


Fig. 3.12. A compact optical pickup head package design (Matsushita).

Major increase in capacity is expected over the next 3 to 5 years using lasers with progressively shorter wavelengths. As mentioned earlier, areal density is governed by spot size, which can be expressed in terms of the wavelength (λ) and the numerical aperture (NA),

of the optical system as

Spot size = $1.18\ \lambda/NA$

In order to reduce the spot size, the numerical aperture may be increased, or the wavelength may be reduced. However, since the numerical aperture also affects the depth of focus (depth of focus ~ NA^{-2}), increasing the numerical aperture imposes restrictions on the media thickness and the servo controllers. Practically, it is expected that the numerical aperture will be increased only up to 0.62 from its present value of 0.55, allowing an increase in the storage capacity of about 12%.

Japanese researchers indicated to JTEC panelists that they expect laser wavelengths to be gradually decreased over the coming years from the present standard of 780 nm to 430 nm, more than doubling the areal density. Sony is actively pursuing this direction by developing zinc-selenide-based lasers. Sony researchers showed the JTEC panel room-temperature DC operation with a lifetime exceeding one hour. In contrast, researchers at Nichia are actively pursuing GaN-based lasers. Recently they have demonstrated lasing using this material. In view of these recent developments, Japanese companies have apparently reduced their research activities on costly frequency-doubled blue lasers.

Another optical approach to decreasing spot size is the use of optical superresolution. Optical superresolution relies on the diffraction properties of focused beams, in that the spot size of a focused beam can be made smaller if the beam intensity profile incident on the focusing lens is in the shape of a ring. Thus, by blocking the central portion of a collimated beam incident onto a focusing lens, spot size can be reduced at the expense of a significant loss in optical power. Because of the optical power loss, this technique does not seem to generate much enthusiasm in companies the panel visited in Japan.

On the other hand, Japanese companies do seem to be putting a great deal of effort into integrating dual-function optical drives capable of recording and reading both CD-ROM and PCR optical disk families. Indeed, the phase-change disk (PD) optical disk system offered by Matsushita allows both the 4X CD-ROM family of disks and single-sided 650 MB PCR optical disks to be used by the same drive. The hope is that the versatility of this system will convince users to switch their CD-ROM drives to PD drives. The key to this technology is a new micro-optical head design that is compatible with both formats. A new PCR media that provides high reliability and high-volume production of these rewritable disks makes this approach attractive and economical. Furthermore, a new tray mechanism that accepts both cartridges and bare CDs adds to the versatility of the system. Matsushita's PD systems offer 650 MB capacity with 870 kB/s transfer rate, and access time in the order of 45 ms at 2026 rpm.

Trends in Optical Storage

Undoubtedly, over the next five years or so, many of the new approaches described above will find their places in the next generations of optical storage products, alone or in combination. At a 1994 workshop organized by OIDA on optical storage, a group of U.S. experts presented a potential scenario describing the order in which these technologies may be introduced and

how they may affect the capacity, seek time, and data rates of optical storage systems. This information is summarized in Figures 3.13 and 3.14.

Interestingly, most of the new techniques described above are for increasing capacity, and few techniques are being investigated for improving seek times and data rates. This might be an indication of a lack of cost-effective solutions to improving the speed of optical disk systems, but it may also indicate that Japan's optical storage industry is focusing on multimedia and entertainment applications with modest speed requirements, thus leaving the mainstream computing applications to magnetic hard disk drives.

Figure 3.14 also points out that parallel readout of optical storage may be an important research direction to increase data rates for certain high-speed applications. However, the main bottleneck limiting data rates is the processor bus speeds, which may only reach 1 Gbit/s over the next five years. Japanese optical storage makers believe they may be able to provide data rates up to 50 to 100 Mbits/s without resorting to parallelism.

It is also important to note from these figures that Japan's optical storage technology roadmap becomes increasingly fuzzy beyond the turn of the millennium, thus leaving the door open for less conventional optical storage techniques. This may present an opportunity for the U.S. industry. As described below, both Japan and the United States are pursuing some less conventional approaches that have the potential to make a long-term impact on the future of this industry.

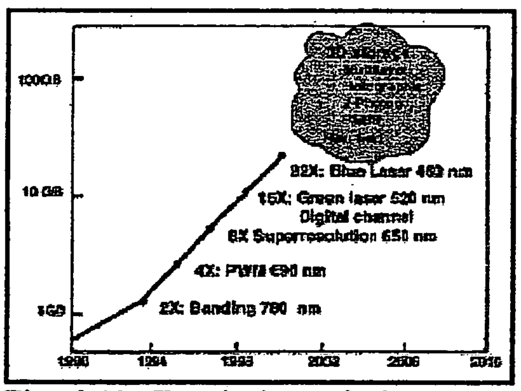


Fig. 3.13. Trends in optical storage: evolution of capacity (OIDA Workshop on Optical Storage 1994).

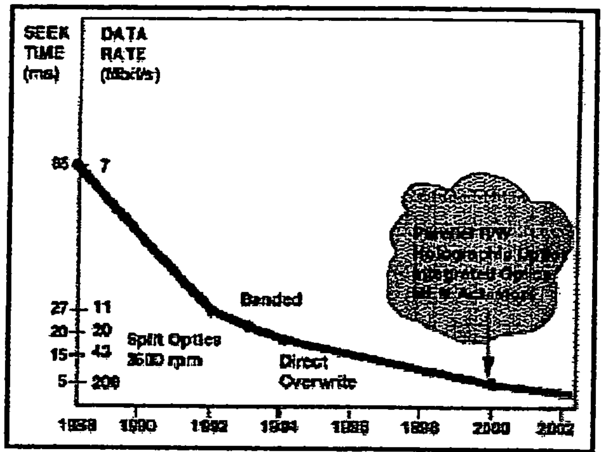


Fig. 3.14. Trends in optical storage: evolution of seek time and data rates (OIDA Workshop on Optical Storage 1994).

Published: February 1996; *WTEC Hyper-Librarian*

■Recordable Optical Pickup Head for Blu-ray Disc『KES-200A』

<Applications>

- Recordable Optical Pickup for Blu-ray Disc
- Dual layer RE Disc (1x speed) available

<Features>

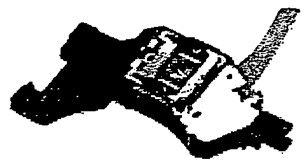
- With mechanism for compensation of Spherical Aberration
- Laser Driver IC with Write Strategy
- High performance 2-Axis actuator

<General Specifications>

Objective Lens Numerical Aperture	0.85	Focus error detection methods	Astigmatic methods
Objective Lens Working Distance	0.15mm	Tracking error detection methods	
Laser Wavelength	405nm	Differential Push-Pull Differential Phase Detection	
Main beam output power	≧ 12mW	Dimensions (W × D × H)	39 × 92 × 23mm
OEIC	CXA2700EM	Datum shaft pitch	84.7mm
Laser Driver IC	CXA2691ER	Weight	50g

NEW Products Announced December 28, 1998

Thin Design Through Lightweight Design
Optical Pickup for Thin 24-Speed CD-ROM Drives
PXR-724U



□¡ OverView

In addition to the notebook computer market, demands for reduced space requirements are mounting in the desktop computer market as well, and thinner internal CD-ROM drives are sought.
This newly developed optical pickup for use in thin 24-speed drives contributes greatly to a thinner CD-ROM drive form factor.

□¡ Feature

1. Unique damping design for superior tracking characteristics
2. Lightweight actuator with improved vibration damping
3. Tracking error signal detection: Three-beam method
   Focusing error signal detection: Astigmatic method
4. Outstanding lightweight design for high-speed access
5. Excellent cost-performance

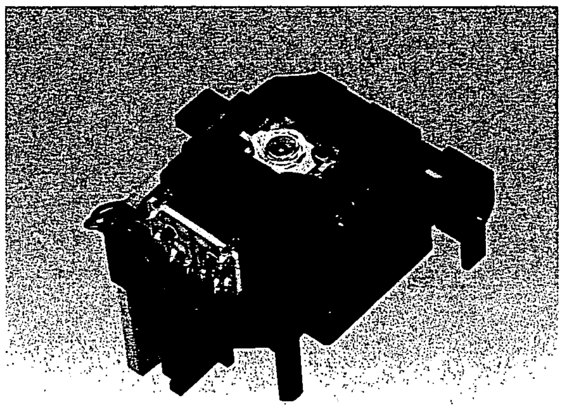
□¡ Specifications

Tracking sensitivity:	0.4mm/V
Tracking resonance frequency:	58Hz
Focusing sensitivity:	0.95mm/V
Focusing resonance frequency:	58Hz
RF signal:	0.7Vp-p
Tracking error signal:	100mV
Focusing error signal:	860mV
External dimensions:	29.5 mm (length) x 45 mm (width) x 7.3 mm (height)
Weight:	5g

Victor・JVC

CDプレーヤ用 光ピックアップ
Optical Pickups for Compact Disc Player
OPTIMA-73

光PUの小型・軽量化に対応
Accommodate to compact & lightweight Optical Pickups



■特長
- ●バランス型アクチュエーター搭載による高い振動特性
- ●小型・軽量
- ●3ビームトラッキングエラー検出方式
- ●PDICタイプ電圧出力

■用途
- ●CD付ミニコンポーネントステレオ
- ●CD付ラジオカセット
- ●ゲーム機（倍速まで）
- ●ビデオCDプレーヤ

■Features
- ●Higher viblation specificity achived by balanced type actuator.
- ●Compact & light weight.
- ●3-Beam tracking error detection method.
- ●PDIC type Output by voltage

■Applications
- ●CD mini component stereo.
- ●CD radio cassette player.
- ●Game machine (up to double speed).
- ●Video CD Player.

この製品を設計している大和工場は環境マネジメントシステムISO14001の登録工場です
登録番号：EC98J1048
登録年月日：1998年8月25日

CDプレーヤ用 光ピックアップ
Optical Pickups for Compact Disc Player

OPTIMA-73

■光学的仕様：Optical Specifications

項目 Item	仕様 Specifications		
対物レンズ Objective Lens	焦点距離 Focal Length	(f)	2.8 mm
	開口数 Numerical Aperture	(N.A.)	0.45
	作動距離 Working Distance	(W.D.)	1.6 mm
半導体レーザー Laser Diode	GaAlAs レーザーダイオード GaAlAs Laser Diode		
	レーザー波長 Laser Wave Length	(λ)	775 nm~800 nm

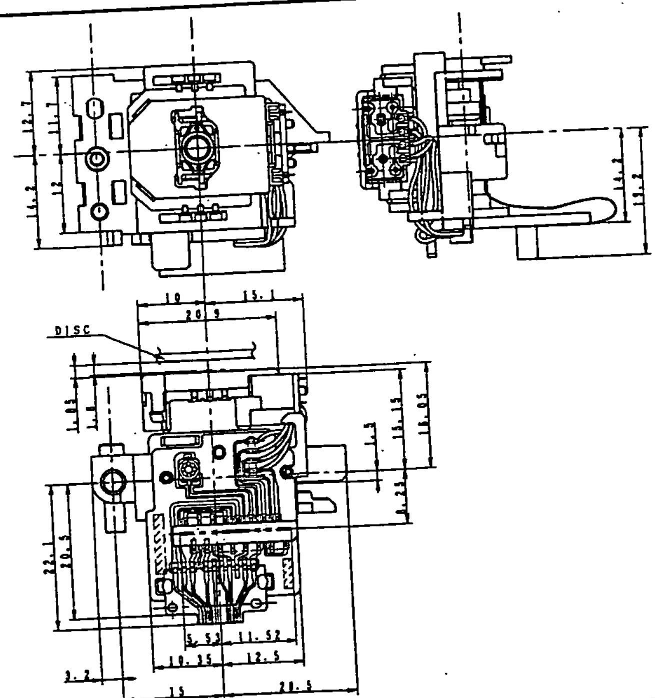
■機械的仕様：Mechanical Specifications

項目 Item	仕様 Specifications	
質量 Weight	0.009 kg	
外形寸法 Dimensions	31.9 mm× 38.7 mm× 38.4 mm	
対物レンズ可動範囲 Movable Distance of the Objective Lens	フォーカス方向：動作基準位置より Focus Axis	±0.75 mm以上
	トラッキング方向：中立位置より Tracking Axis	±0.5 mm以上

■電気的仕様：Electrical Specifications

項目 Item		仕様 Specifications OPTIMA-73
アクチュエーター部 Actuator	フォーカス感度 (1Hz) Focus Sensitivity	1.0 mm/V
	フォーカス共振周波数 Focus Resonance-freq	29 Hz
	トラッキング感度 (1Hz) Tracking Sensitivity	1.2 mm/V
	トラッキング共振周波数 Tracking Resonance-freq	29 Hz
光学部 Optical/Electrical (当社標準評価回路使用の場合)	RF信号 RF Level	0.87 V(p-p)
	フォーカスエラー信号 Focus Error Signal	3.7 V(p-p)
	トラッキングエラー信号 Tracking Error Signal	1.0 V(p-p)

■外形寸法：Dimensions (mm)



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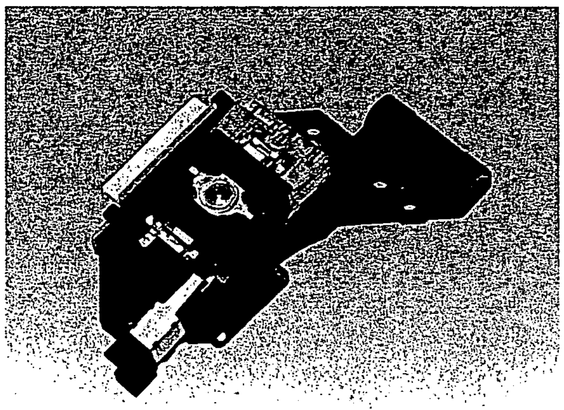
0203

Victor・JVC

CAR CD /AUDIO用 光ピックアップ
Optical Pickup for Car CD / Audio
OPTIMA-715



■特長
● PDIC搭載
● 高速シーク対応の軽量化設計モデル
● 小型/高感度アクチュエーター搭載

■Features
● Equipped with PDIC.
● High speed seeking, and light weight design model.
● Compact & equipped with high-sensitivity actuator.

■用途
● Audio用CDプレーヤー
● 車載CDプレーヤー

■Applications
● Audio CD player
● Car CD Player

ISO 14001 JACO　UKAS ENVIRONMENTAL MANAGEMENT 051

この製品を設計している大和工場は環境マネジメントシステムISO14001の登録工場です

登録番号：EC98J1048
登録年月日：1998年8月25日

CAR CD / AUDIO用 光ピックアップ
Optical Pickups for Car CD / Audio

OPTIMA-715

■光学的仕様：Optical Specifications

項目 Item	仕様 Specifications		
対物レンズ Objective Lens	焦点距離 Focal Length	(f)	2.8 mm
	開口数 Numerical Aperture	(N.A.)	0.45
	作動距離 Working Distance	(W.D.)	1.6 mm
半導体レーザー Laser Diode	GaAlAs レーザーダイオード GaAlAs Laser Diode		
	レーザー波長 Laser Wave Length	(λ)	775 nm~815 nm
サーボエラー信号検出方式 Servo Error Detection Method	フォーカスエラー Focus Error		SSD法 Spot Size Detection Method
	トラッキングエラー Tracking Error		3ビーム法 3-Beam Method

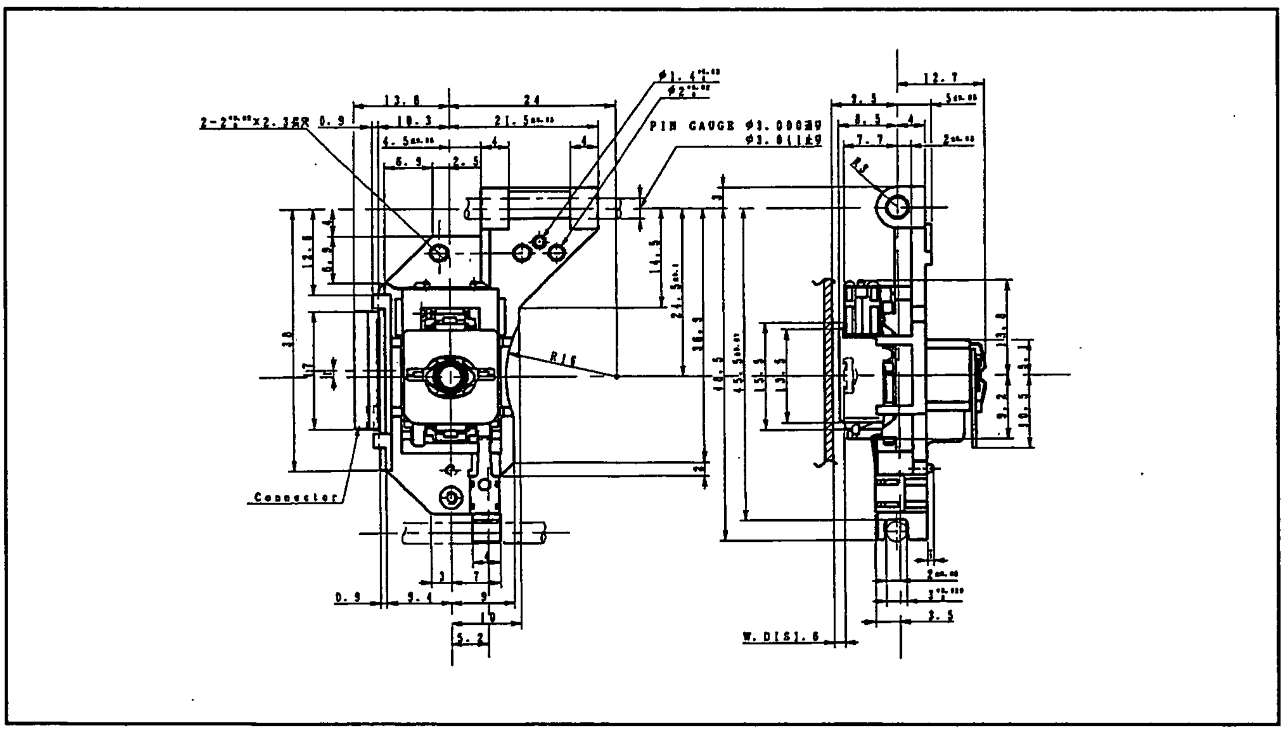
■機械的仕様：Mechanical Specifications

項目 Item	仕様 Specifications	
質量 Mass	約 0.01 kg	
外形寸法 Dimensions	51.5 mm× 35.3 mm× 21.2 mm	
対物レンズ可動範囲 Movable Distance of the Objective Lens	フォーカス方向：動作基準位置より Focus Axis	±0.75 mm
	トラッキング方向：中立位置より Tracking Axis	±0.5 mm

■電気的仕様：Electrical Specifications

項目 Item	仕様 Specifications	
アクチュエーター部 Actuator	フォーカス感度 (1Hz) Focus Sensitivity	1.5 mm/V
	トラッキング感度 (1Hz) Tracking Sensitivity	1.3 mm/V
光学部 Optical/Electrical [当社標準回路使用の場合]	RF信号 RF Level	1.0 V(p-p)
	フォーカスエラー信号 Focus Error Signal	4.5 V(p-p)
	トラッキングエラー信号 Tracking Error Signal	1.15 V(p-p)

■外形寸法：Dimensions (mm)



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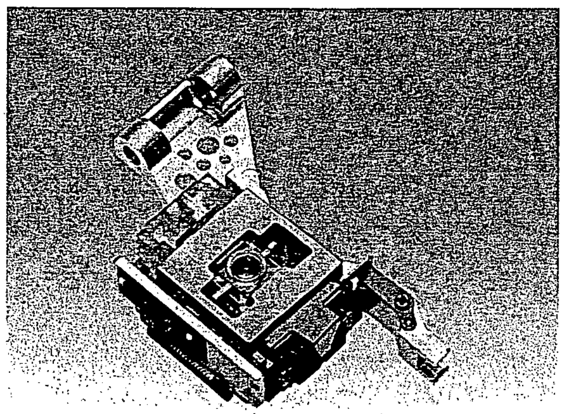
Victor・JVC

CAR CD/AUDIO用 光ピックアップ
Optical Pickups for Car CD / Audio
OPTIMA-725

業界トップレベルの耐熱特性4倍速対応

Top ranking heat resistance characteristics in the industry
Accomodates up to ×4 speed



■特長

- 業界トップレベルの耐熱特性
- バランス型アクチュエーター搭載による高い振動特性
- 薄型設計

■Features

- Top ranking heat-resistance specificity in the industry.
- Higher viblation specificity achieved by balanced type actuator.
- Low profile design.

■用途

- 車載CDプレーヤ
- ポータブルCDプレーヤ

■Applications

- Car CD Player
- Portable CD Player

ISO 14001 JACO / UKAS ENVIRONMENTAL MANAGEMENT 051

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登録番号：EC98J1048
登録年月日：1998年8月25日

CAR CD / AUDIO用 光ピックアップ
Optical Pickups for Car CD / Audio

OPTIMA-725

■光学的仕様：Optical Specifications

項目 Item		仕様 Specifications	
対物レンズ Objective Lens	焦点距離 Focal Length	(f)	2.8 mm
	開口数 Numerical Aperture	(N.A.)	0.45
	作動距離 Working Distance	(W.D.)	1.6 mm
半導体レーザー Laser Diode	GaAlAs レーザーダイオード GaAlAs Laser Diode		
	レーザー波長 Laser Wave Length	(λ)	775 nm~800 nm
サーボエラー信号検出方式 Servo Error Detection Method	フォーカスエラー Focusing Error		SSD法 Spot Size Detetction Method
	トラッキングエラー Tracking Error		3ビーム法式 3-Beam Method

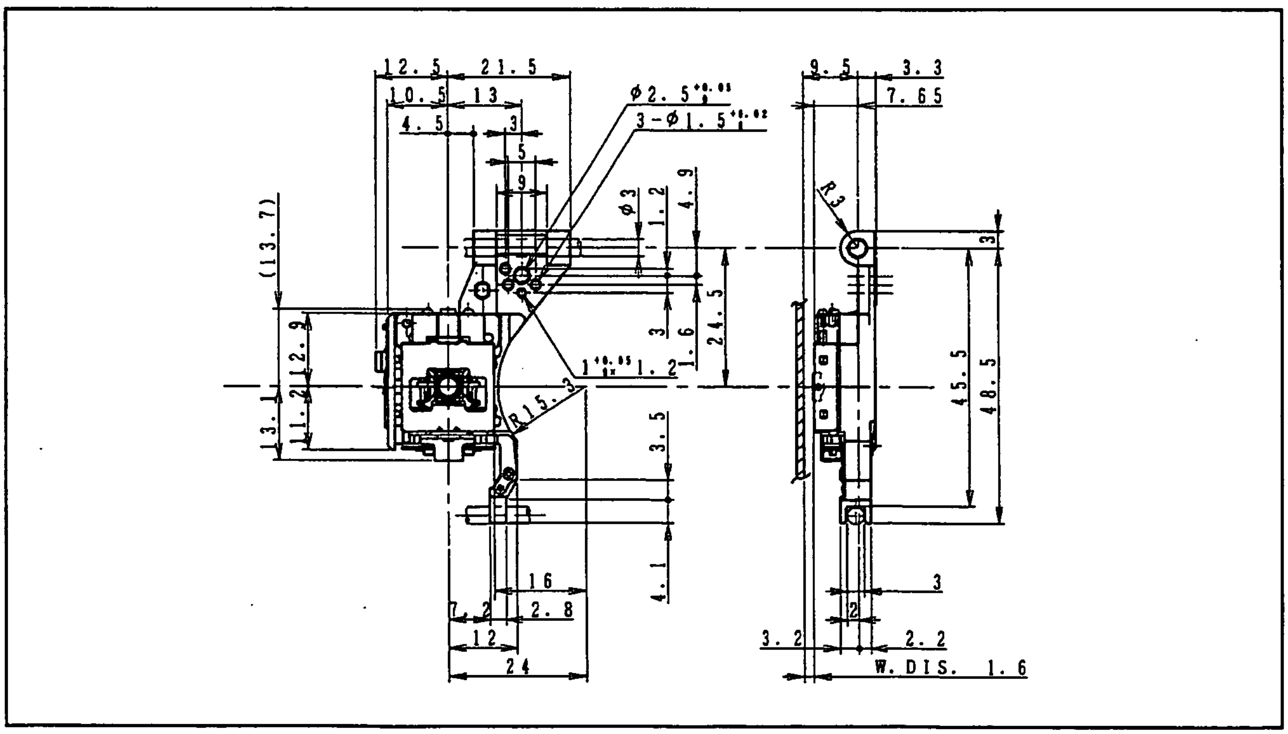
■機械的仕様：Mechanical Specifications

項目 Item		仕様 Specifications
質量 Mass		約0.017 kg
外形寸法 Dimensions		51.5 mm× 34 mm× 11mm
対物レンズ可動範囲 Movable Distance of the Objective Lens	フォーカス方向：動作基準位置より Focus Axis	±0.9 mm
	トラッキング方向：中立位置より Tracking Axis	±0.5 mm

■電気的仕様：Electrical Specifications

項目 Item		仕様 Specifications
アクチュエーター部 Actuator	フォーカス感度 (1Hz) Focus Sensitivity	0.95 mm/V
	トラッキング感度 (1Hz) Tracking Sensitivity	0.9 mm/V
光学部 Optical/Electrical [当社標準回路使用の場合]	RF信号 RF Level	1.0 V(p-p)
	フォーカスエラー信号 Focus Error Signal	4.5 V(p-p)
	トラッキングエラー信号 Tracking Error Signal	1.15 V(p-p)

■外形寸法：Dimensions（mm）



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